

What is claimed is:

- 1 1. A method for identifying music, comprising the steps of:
 - 2 (a) recording a sample of audio data;
 - 3 (b) deriving a sample time signal from the audio data;
 - 4 (c) sorting a plurality of songs, wherein each song is represented by a time signal;
5 and
 - 6 (d) matching the sample time signal with the time signal of a song in the plurality
7 of songs.
- 8 2. The method of claim 1, where the sorting step further comprises:
 - 9 generating a sample feature vector for the sample time signal;
 - 10 generating a feature vector for each time signal of the songs; and
 - 11 sorting the songs in an ascending order based on feature space distance between
12 the sample feature vector and respective feature vectors for each time signal of the songs.
- 13 3. The method of claim 2, where the generating steps further comprise extracting
14 features from the sample time signal and the time signals of the songs.
- 15 4. The method of claim 3, where the features comprise beat, noise, tone, pitch,
16 loudness and tempo.
- 17 5. The method of claim 1, where the sorting step further comprises:
 - 18 generating a sample feature vector for the sample time signal;
 - 19 generating a plurality of feature vectors for one or more time signals of the songs,
20 wherein each feature vector of the plurality of feature vectors for a time signal is
21 generated from a different segment of the song corresponding to the time signal;
22 separating the plurality of feature vectors for each time signal as distinct entries;
23 and
 - 24 sorting the entries in an ascending order based on feature space distance between
25 the sample feature vector and respective feature vectors for the entries.
- 26 6. The method of claim 2, where the matching step further comprises:
 - 27 comparing the sample time signal to a first time signal in the ascending order;
 - 28 computing a signal match waveform for the first time signal in relation to the
29 sample time signal;
 - 30 playing the song corresponding to the first time signal if the signal match
31 waveform satisfies a decision rule;
 - 32 indicating by a user whether the played song matches the sample of audio data;
33 and

- 1 presenting to the user song information corresponding to the first time signal if the
2 user indicates a match.
- 3 7. The method of claim 6, where the signal match waveform is computed by
4 calculating a cross-correlation of the first time signal in relation to the sample time signal.
- 5 8. The method of claim 7, where the decision rule is satisfied if an overall absolute
6 maximum of the cross-correlation computed for the first time signal is greater than an
7 average cross-correlation by a predetermined factor.
- 8 9. The method of claim 7, where the decision rule is satisfied if an overall absolute
9 maximum of the cross-correlation computed for the first time signal is greater than an
10 average cross-correlation by a predetermined factor, and no incorrect songs have been
11 presented to the user.
- 12 10. The method of claim 6, where the song information comprises song title, artist and
13 performance.
- 14 11. The method of claim 6, further comprising, after the computing step, the step of:
15 comparing the sample time signal to a next time signal in the ascending order, and
16 subsequently repeating the computing step with respect to the next time signal, if the
17 signal match waveform does not satisfy the decision rule for the first time signal.
- 18 12. The method of claim 6, further comprising the step of:
19 comparing the sample time signal to a next time signal in the ascending order, and
20 subsequently repeating the computing, playing, indicating and presenting steps with
21 respect to the next time signal, if the user indicates that the played song does not match
22 the sample of audio data.
- 23 13. A system for identifying music, comprising:
24 a means for recording a sample of audio data;
25 a means for deriving a sample time signal from the audio data;
26 a means for sorting a plurality of songs, wherein each song is represented by a
27 time signal; and
28 a means for matching the sample time signal with the time signal of a song in the
29 plurality of songs.
- 30 14. The system of claim 13, where the means for sorting further comprises:
31 a means for generating a sample feature vector for the sample time signal;
32 a means for generating a feature vector for each time signal of the songs; and

- 1 a means for sorting the songs in an ascending order based on feature space
2 distance between the sample feature vector and respective feature vectors for each time
3 signal of the songs.
- 4 15. The system of claim 14, where the means for generating a sample feature vector
5 and the means for generating a feature vector for each time signal of the songs further
6 comprise a means for extracting features from the sample time signal and the time signals
7 of the songs.
- 8 16. The system of claim 15, where the features comprise beat, noise, tone, pitch,
9 loudness and tempo.
- 10 17. The system of claim 13, where the means for sorting further comprises:
11 a means for generating a sample feature vector for the sample time signal;
12 a means for generating a plurality of feature vectors for one or more time signals
13 of the songs, wherein each feature vector of the plurality of feature vectors for a time
14 signal is generated from a different segment of the song corresponding to the time signal;
15 a means for separating the plurality of feature vectors for each time signal as
16 distinct entries; and
17 a means for sorting the entries in an ascending order based on feature space
18 distance between the sample feature vector and respective feature vectors for the entries.
- 19 18. The system of claim 14, where the means for matching further comprises:
20 a means for comparing the sample time signal to a first time signal in the
21 ascending order;
22 a means for computing a signal match waveform for the first time signal in
23 relation to the sample time signal;
24 a means for playing the song corresponding to the first time signal if the signal
25 match waveform satisfies a decision rule;
26 a means for indicating by a user whether the played song matches the sample of
27 audio data; and
28 a means for presenting to the user song information corresponding to the first time
29 signal if the user indicates a match.
- 30 19. The system of claim 18, where the signal match waveform is computed by
31 calculating a cross-correlation of the first time signal in relation to the sample time signal.
- 32 20. The system of claim 19, where the decision rule is satisfied if an overall absolute
33 maximum of the cross-correlation computed for the first time signal is greater than an
34 average cross-correlation by a predetermined factor.

- 1 21. The system of claim 19, where the decision rule is satisfied if an overall absolute
2 maximum of the cross-correlation computed for the first time signal is greater than an
3 average cross-correlation by a predetermined factor, and no incorrect songs have been
4 presented to the user.
- 5 22. The system of claim 18, where the song information comprises song title, artist
6 and performance.
- 7 23. A method for identifying music, comprising the steps of:
8 (a) recording a sample of audio data;
9 (b) deriving a sample time signal from the audio data; and
10 (c) matching the sample time signal with a time signal of a plurality of time
11 signals in a database, wherein each of the plurality of times signals represents a song in
12 the database.
- 13 24. The method of claim 23, where the matching step further comprises:
14 computing a signal match intensity for the plurality of time signals in the database
15 in relation to the sample time signal;
16 selecting a time signal of the plurality of time signals having a maximum signal
17 match intensity; and
18 presenting to a user song information corresponding to the selected time signal.
- 19 25. The method of claim 24, where the song information comprises song title, artist
20 and performance.
- 21 26. A system for identifying music, comprising:
22 a means for recording a sample of audio data;
23 a means for deriving a sample time signal from the audio data; and
24 a means for matching the sample time signal with a time signal of a plurality of
25 time signals in a database, wherein each of the plurality of time signals represents a song
26 in the database.
- 27 27. The system of claim 26, where the means for matching further comprises:
28 a means for computing a signal match intensity for the plurality of time signals in
29 the database in relation to the sample time signal;
30 a means for selecting a time signal of the plurality of time signals having a
31 maximum signal match intensity; and
32 a means for presenting to a user song information corresponding to the selected
33 time signal.

- 1 28. The method of claim 27, where the song information comprises song title, artist
2 and performance.
- 3 29. A method for identifying music, comprising the steps of:
4 (a) recording a sample of audio data;
5 (b) generating a first plurality of time signals from the sample of audio data,
6 wherein the first plurality of time signals are generated in distinct frequency bands;
7 (c) generating a second plurality of time signals from songs in a database, wherein
8 the second plurality of time signals are generated in the same distinct frequency bands as
9 the first plurality of time signals; and
10 (d) matching the first plurality of time signals with the second plurality of time
11 signals.

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